

Major Constraints to Agriculture, Forestry and Fisheries Development and Sustainability in South Asia

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The South Asian countries, defined as low-income countries with per capita GNP of US\$ 755 or less, improved their economic performance in 1990s with GDP growth rate varying from 4 percent in Pakistan to 6.1 percent in India. However, much of this growth was negated by the growth in population, resulting in a moderate rate of growth in per capita income. The national poverty line indicates that more than 34 percent of the population in these lives below the poverty line. The international poverty line (percent of population below 1 dollar a day) indicates a high concentration of poverty in the region. The estimate varies from 6.6 percent in Sri Lanka to 44 percent in India. A vast majority of children is malnourished. Alleviation of poverty and malnutrition therefore will continue to be a major challenge in South Asia.

Nearly three-fourths of the poor people in South Asian countries are concentrated in rural areas and depend on agriculture for food, employment and income. The landless farm workers account for more than 40 percent of rural poverty. The rest are small and marginal cultivators and tenants. Agricultural and rural development is central to a strategy aimed at alleviating poverty and food insecurity, apart from serving to fuel industrialization. The past three decades of agricultural growth clearly supports this view. However, recurring problems with demographic transition, natural resource degradation, and malnutrition appear to be more pressing now than ever before. New challenges are likewise emerging from global developments in trade. This concern coupled with acceleration of agricultural growth for higher income and food and nutrition security and sustainable management and use of natural resources will continue to influence investment priorities in the region.

Production constraints

South Asia could be divided into six major agro-ecoregions (AERs): (i) Hot Arid, (ii) Semi-Arid, (iii) Irrigated Sub-Humid, (iv) High Rainfall Humid, (v) Sub-Humid to Humid Coasts, and (vi) Sub-Humid to Cold Arid Mountains. Regional spread, climate, major cropping systems and economic significance of these AERs are given in Table 1. The Semi-Arid, High Rainfall Humid, and Irrigated Sub-Humid AERs are quite large, occupying

38.1%, 26.4% and 19%, respectively, of the total net sown area in South Asia. They contribute about one-fourth each to the total value of agricultural output. The High Rainfall Humid AER, largely practicing rice-based production system, is of greater significance as it has lot of growth potential, and a large proportion of poor people live in this region. The Irrigated Sub-Humid system practices rice-wheat, cotton-wheat and sugarcane-wheat cropping systems. Both canal and tubewell irrigation are intensively used, along with other modern inputs like fertilizers. Livestock is important in all the systems, but horticultural crops are widely grown in the Semi-Arid and the Coastal AERs.

A literature survey on the topic gives a fairly good understanding of generic production constraints in the various AERs (Table 2). These production constraints are further classified into three categories: (a) natural resource-related constraints, (b) other technical constraints, and (c) socio-economic constraints (Table 3). Inadequacy of data does not permit us to analyse relative importance of these three types of constraints, but as felt by participants of the expert consultation and reported in some studies, these constraints cause significant production losses. For example, abiotic stresses like drought and submergence caused significant production losses in rice in eastern India. Decreasing profits because of high capitalization of farming systems and depletion of natural resources, particularly groundwater are serious binding constraints in the Irrigated agro-ecoregion. Production environment is becoming more hostile in the Arid and Semi-Arid agro-ecoregions and opportunities for employment and income growth are less. Diversity of production systems, low infrastructure development and technology penetration, lack of markets, labor migration, etc. are major constraints to development of hill and mountain agriculture. Livestock, which is important to smallholders and landless laborers for generation of employment and income in all AERs, is constrained by a number of factors, such as poor nutrition due to non-availability of feed and fodder, high incidences of diseases and less developed markets and other infrastructure facilities. Production losses due to socio-economic constraints in all AERs and sub-sectors of agriculture are also significant but difficult to estimate. A systematic strategy to address all these constraints successfully through harnessing scientific opportunities (Tables 2 and 3) should guide further prioritization of research programs for various AERs.

Table 1. Important agro-ecoregions of South Asia

Particular	Hot Arid Agro-ecoregion	Semi-Arid Agro-ecoregion	Irrigated Sub-Humid Agro-ecoregion	High Rainfall Humid Agro-ecoregion	Sub-Humid to Humid Coastal Agro-ecoregion	Sub-Humid to Cold Arid Mountain Agro-ecoregion
Regional coverage	Desert of India and Pakistan; arid and plateau region of Baluchistan in Pakistan	Rainfed peninsular and west India; rainfed region of Pakistan Punjab and Sindh; part of Sri Lanka	Irrigated region of north-west India (upper Indo-Gangetic Plains) and irrigated region of Pakistan (Punjab and Sindh); part of <i>tarai</i> region of Nepal	Eastern India (irrigated or lower Indo-Gangetic region, and rainfed or eastern Plateau region); Bangladesh; part of <i>tarai</i> region of Nepal	Coastal regions of India and Bangladesh; part of Sri Lanka; Maldives	Hill and mountain region of India, Nepal and Pakistan; Bhutan
Rainfall (mm)	<300	500-1000	500-1200	1000-2000	900-3200	<150-4000
Dominant cropping systems	Millet, pulses and oilseed-based	Coarse cereal-pulse-based; cotton-based; oilseed-based; rice and sugarcane-based in irrigated areas	Rice-wheat; sugarcane-wheat; cotton-wheat; maize-wheat	Rice-rice; rice-wheat; rainfed rice-based; rice-vegetables; rice-fish; fruits	Rice-coconut-based; plantation crops; fruits; brackishwater shrimp and fish	Millet and wheat in cold arid; rice, coarse cereals and wheat-based
Share in the total net sown area (%)	7.3	38.1	19.0	26.4	5.8	3.4
Share in total value of agricultural production (%)	2.91	25.40	28.59	26.63	10.36	6.11

Table 2. Major production systems, problems and opportunities by agro-ecoregion

	Hot Arid, and Semi-Arid Agro-ecoregion	Irrigated Sub-Humid Agro-ecoregion	High Rainfall Humid; and Sub-Humid to Humid Coastal Agro-ecoregions	Sub-Humid to Cold Arid Mountain Agro-ecoregion
Production Systems	Coarse cereals-based; cotton-based; oilseed (groundnut and soybean)-based; rice and sugarcane-based in irrigated areas; livestock; horticultural crops	Rice-wheat; cotton-wheat; sugarcane-wheat; maize-wheat; buffalo for home dairy; commercial meat and dairy	Unfavourable, rainfed, flooded: Rice-pulses/oilseeds/minor grains; rice-jute; rice-fish/freshwater prawn; Favourable irrigated: Rice-rice; rice-wheat; rice-vegetables; rice-fish; horticultural and plantation crops; brackishwater shrimp and fish; open water culture-based fishery; crop-livestock systems (Bengal goat)	Low (3000-5000 feet) and mid (5000-8000 feet) heights: Rice-wheat; rice-potato; maize-potato; horticultural crops; trees (fodder and fuel); cattle, buffalo, sheep, goat, poultry Upper (>8000 feet) heights: Sheep, goat, horticulture, forestry, medicinal plants
Characteristics and constraints	<ul style="list-style-type: none"> • Risky environment • Erratic and scanty rainfall • Drought prone • High incidence of poverty • Land degradation, salinization and deterioration of soil health • Low productivity and high yield losses • Lack of opportunities for income generation 	<ul style="list-style-type: none"> • High productivity but low profitability of cereal systems • High and overcapitalized mechanization • High levels of input use but low input use efficiency • Relatively low levels of agro-ecoregion diversity • Salt affected areas • Groundwater depletion, soil erosion and exhaustion of past sources of productivity growth (varieties, fertilizers) 	<ul style="list-style-type: none"> • Low level of productivity and large yield gaps • Excess and deficit water regimes, and contamination of arsenic • Soil degradation and erosion • Biotic and abiotic stresses • Poor infrastructure and transfer of technology • Fragmented small holdings • Undeveloped markets, low industrialization • High incidence of poverty • Prone to natural disasters- drought, flood, cyclones, rise in sea level 	<ul style="list-style-type: none"> • Diverse production systems because of differences in altitude, slope, soil, etc. • Poor infrastructure and low technology transfer • Water- excess and deficit • Soil erosion and loss of bio-diversity • Deforestation • High post-harvest losses • Jhum cultivation • High incidence of poverty and labor migration
Opportunities	<ul style="list-style-type: none"> • Diversification of systems • Soil and water management • Market integration • Biotechnology tools and integrated pest management (IPM) for control of biotic stresses 	<ul style="list-style-type: none"> • Diversification of systems- livestock • Soil and water management- zero tillage • Precision farming • IPM • Market integration 	<ul style="list-style-type: none"> • High rainfall, water management • Diversified systems • Dry season cereals (boro rice) • Aquatic system development • Market integration • Biotechnology tools and IPM for control of biotic stresses • Livestock development 	<ul style="list-style-type: none"> • Post-harvest processing and value addition • Potential for off-season vegetables, fruits and plantation crops • Aquaculture, bee keeping, floriculture and seed production • Livestock • Ecotourism

Table 3. Major production constraints and growth opportunities in various agro-ecoregions

Agro-ecoregion	Major production constraints			Opportunities
	<i>Natural resources-related</i>	<i>Technical constraints</i>	<i>Socio-economic constraints</i>	
<i>South Asia</i>				
Hot Arid Agro-ecoregion	Desert soil, soil erosion by wind, very low rainfall, frequent droughts, acute shortage of groundwater	Saline and alkaline soil in coastal area, shortage of fodder	High risk, resource poor farmers	Arid horticulture, livestock
Semi-Arid Agro-ecoregion	Deterioration of soil and groundwater resources, erratic rainfall, soil erosion due to water	Biotic stresses, moisture stress, low to poor soil fertility, low yields, limited use of crop products	High risk, resource poor farmers, threats from opening of markets, declining consumption of coarse cereals, high incidence of poverty, weakening of traditional institutions for management of natural resources	Diversification towards high value crops, scope for rainwater harvesting and use
Sub-Humid to Cold Arid Mountain Agro-ecoregion	Diverse production environments, highly fragmented small holdings	High post-harvest losses, root stock susceptible to biotic and abiotic stresses	Resource poor farmers, poor infrastructure and institutional development, high incidence of poverty, labor migration	Rich biodiversity, value addition through processing, Horticulture and off season vegetables, ecotourism
Irrigated Sub-Humid Agro-ecoregion	Deteriorating soil and water resources, salinity and water logging	Stagnant crop yields, late planting of crops, pest buildup, inefficiency in input/resource use, nutrient depletion, poor plant stand, low productive efficiency in livestock	Shortage of labour, high population pressure, unstable prices of commercial crops, deceleration in total factor productivity	Favourable production environment, developed infrastructure and institutions
High Rainfall Humid Agro-ecoregion	Adverse soils, soil erosion by water, submergence, drought and flood prone, Diverse production environment, Soil Salinity, arsenic contaminated groundwater	High incidence of biotic stresses, low soil fertility, and nutrient deficiency high mentality in livestock	High risk, low input use, poor infrastructure and institutional development, high incidence of poverty, low non-farm employment opportunities	High rainfall, scope for diversification, <i>boro</i> rice, rich biodiversity, inland aquaculture
Sub-Humid to Humid Coastal Agro-ecoregion	Deterioration of land and water resources, soil salinity, frequent cyclones	Low soil fertility, diseases in inland fisheries, biotic stresses	High risk, competitive export market of plantation crops	Expansion of inland aquaculture

Summing up

This note has discussed on major production constraints and growth opportunities, which can be used for identification of priority research themes. The results indicate increasing importance of livestock and horticultural sector in the region, besides continuing emphasis on food crops—rice, wheat and pulses. The Humid agro-ecoregion comprising eastern India and Bangladesh should get high priority because of high vulnerability to resource degradation and risk, growth potential and likely impact of poverty. In terms of broad research themes, soil and water management, commercialization and diversification of production systems, market integration, livestock (including fisheries) health and nutrition, mapping of poverty, sustainable seed and technology systems are some of the high priority areas. These priority themes may also be of common interest to all stakeholders (IARCs, NARSs, private sector, donors, etc).

Supporting reading material

Mruthyunjaya and Suresh Pal (2002). Agricultural research priorities for South and West Asia. In *Agricultural research priorities for the Asia-Pacific region- a synthesis*. Bangkok: APAARI.

Ryan, JG and D Spencer (2001). *Future challenges and opportunities for agricultural R&D in the semi-arid tropics*. Patancheru: ICRISAT.